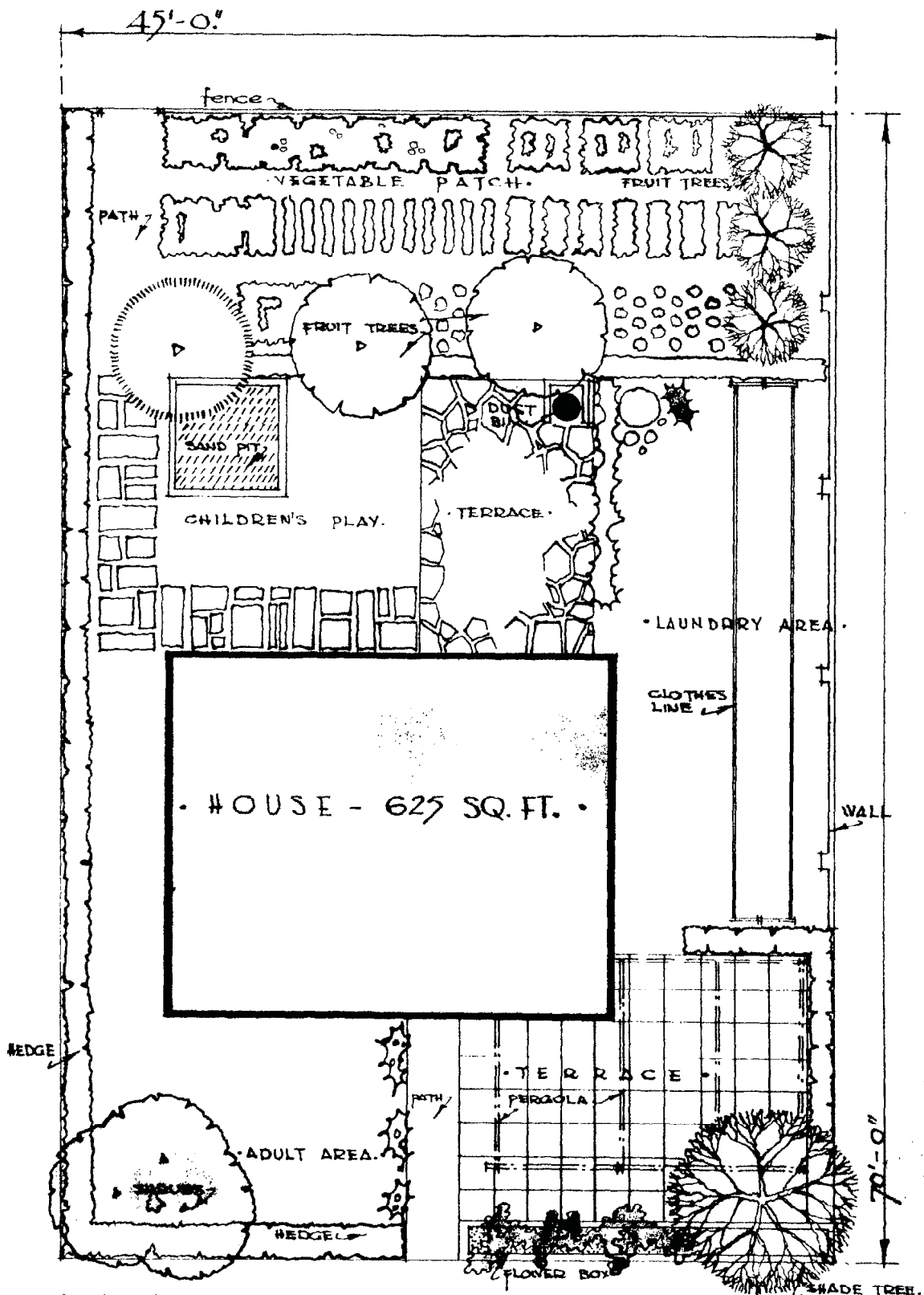


# STUDY OF PLOT SIZE.



• P L A N . • SCALE : 1 INCH TO 8 FEET. •

AREA OF PLOT = 3150 SQUARE FEET.

VEGETABLE PLOT = 500 SQ. FT.; LAUNDRY = 300 SQ. FT.;

CHILDREN'S PLAY = 240 SQ. FT.; UTILITY AREA = 180 SQ. FT.;

ADULT RECREATION = 500 SQ. FT.; SERVICE & CIRCULATION = 1430 SQ. FT.

• LAYOUT OF MINIMUM GARDEN. •

Laundry area	225 square feet.
Dustbin and store room	34 " "
Compost heap	20 " "
Children's play area	100 " "
Adult recreation area	500 " "
Cultivation area	400 " "
10% of the above for circulation	128 " "
Area of low-cost dwelling*	800 " "
TOTAL .....	<u>2207 square feet.</u>

Having now arrived at a useful area, it is necessary to allow for a perimeter hedge which is about 3'-0" wide. Taking the ratio of width to depth of plot as 1:2, the useful plot size would be approximately 66'-9" x 33'-6"; the additional plot area for hedge would be 400 sq.ft., allowing side fences as communal. Now in considering screens of shrubs and two shady trees on the plot, a further area of 200 sq. feet is required, giving a total plot area of 2800 square feet.

The provision of sunlight and fresh air has been studied, and for ideal conditions at any latitude in South Africa, the following spaces between single storey buildings are recommended:-

Front and Rear Space\*\*- 50'-0" (building to building)  
 \*\*i.e. front to front,  
 rear to rear, or  
 rear to front.  
 Side Space - 20'-0" (building to building)

In order to achieve these conditions, the type of dwelling selected makes different space demands. If a detached house is considered, then, with a building line of 14'-0", which is measured from building to front boundary of plot, a stand 50' x 70' is required for a house of 800 square feet; the case of a semi-detached house results in a plot 40' x 70' and a row house demands only a 30' x 70' plot. When the space requirements are considered, it will be seen that the detached house on a 50' x 70' plot is in excess, the semi-detached unit is correct whereas the row house is below the space requirements. In actual layouts however, the side spaces

left / ...

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The area allows for an economic dwelling which may exceed this area in which case plot sizes should be slightly increased.

\*\* During the taping out tests, the author arrived at the interesting case shown in Figure No. 22, which illustrates a plot of 3150 sq. ft. with a detached dwelling of 650 sq. ft. The layout illustrated gives a very good idea of how the useful areas can be planned in practice.

left in the detached and semi-detached units tend to be wasteful, whereas in row houses, the shape of the plot is the most economical when considering circulation and hedges. The solution then to plot sizes in practice, is a mean between the space requirements and ideal provision of light and air. Reducing the spacing between units to 40'-0" front to front, rear to rear, or front to rear, and the side space to 16'-0", the following plot areas are recommended.

Detached houses.	3200 square feet.
Semi-detached houses	2800 square feet.
Row houses.	2400 square feet (with the provision of greater communal amenities in the layout).

Since the time of the author's experiment, an article entitled "The Use of Gardens for Food Production", by R. Mackintosh and G.P. Wibberley, appeared in the 1952, January, issue of the Journal of the Town Planning Institute. It is interesting to note the results of this pilot survey carried out in London, as the gardens concerned were developed freely by the tenants. In the plots, which range from 2250 to 3150 square feet, about 15% is set aside for cultivation, i.e. from 330 square feet for small plots to about 470 square feet for larger plots. The other important point is that as plots increase in area from 3150 square feet to 7605 square feet, the percentage devoted to vegetable garden increases from 15% to about 16%, whereas the area under lawn and flowers increases from 47% to 53%, indicating that larger plots devote more space to social activities but not necessarily to the production of food. Considering then the plot areas which are within the limits of the author's minimum plots, the area devoted to cultivation is very similar whether based upon free development or upon experimentation.

Special Notes in respect of Row Houses and Multi-family dwelling units.

TABLE XVI.

AREA OF PLOTS FOR SINGLE STOREY DEVELOPMENT.

Type of dwelling.	Area of plot in sq. ft.		Maximum coverage*
	Ideal area	Minimum area.	
Detached houses	3500	3200	30%
Semi-detached houses	3000	2800	30%
Row houses**	2600	2400	30%

When / ...

\* Coverage is the maximum percentage of the horizontal area of the site of the building permitted to be built on. See Figure BRA/K/23.

\*\* In row houses not more than eight dwellings in one continuous length is suggested as a maximum.

AREA OF HOUSE.	TYPES OF HOUSES, SHOWING DIMENSIONS.			
	DETACHED. 1.	SEMI-DETACHED. 2.	SINGLE STOREY ROW.	DOUBLE STOREY ROW.
600. SQ. FT.		DIMENSIONS OF SEMI-DETACHED SAME AS COLUMN 1. DETACHED.		COVERAGE 450 SQ. FT.
700. " "				500. " "
800. " "				550. " "
900. " "				600. " "
1000. " "				650. " "
1200. " "				750. " "
1400. " "				850. " "

• TABLE 1. DIMENSIONS OF HOUSES  
SCALE: 1 INCH = 100 FEET.

AREA OF HOUSE.	MIN. PLOT 30% COVER AREA.	DETACHED.		SEMI-DETACHED		SINGLE STOREY ROW.		DOUBLE STOREY ROW.	
		AREA.	PLOT SIZE	AREA.	PLOT SIZE.	AREA.	PLOT SIZE.	AREA.	PLOT SIZE.
600. SQ. FT.	2000. SQ. FT.	2790 SQ. FT.	45' x 62'	2170 SQ. FT.	35' x 62'	2000 SQ. FT.	25' x 80'	1500. SQ. FT.	15' x 100'
700. " "	2333. " "	3008 " "	47' x 64'	2368 " "	37' x 64'	2333. " "	26' x 90'	1666. " "	15' x 111'
800. " "	2666. " "	3200 " "	50' x 64'	2680. " "	40' x 67'	2666. " "	30' x 88'	1833. " "	15' x 122'
900. " "	3000. " "	3520 " "	55' x 64'	3015 " "	45' x 67'	3000 " "	30' x 100'	2000. " "	20' x 100'
1000. " "	3333. " "	3776 " "	59' x 64'	3332 " "	49' x 68'	3333. " "	30' x 111'	2166. " "	20' x 108'
1200. " "	4000. " "	4224 " "	66' x 64'	4032 " "	56' x 72'	4000. " "	40' x 100'	2500. " "	25' x 100'
1400. " "	4666. " "	4864 " "	76' x 64'	4686 " "	66' x 71'	4666. " "	46' x 100'	2833. " "	25' x 113'

• DISTANCES.

THIS SIDE OF LINE CONTROL BY DISTANCES BETWEEN UNITS

• COVERAGE.

THIS SIDE OF LINE CONTROL BY MAX. COVERAGE OF 30%.

• TABLE 2. AREA & DIMENSIONS OF STANDS FOR VARIOUS SIZED HOUSES. COVERAGE & SPACING CONTROL.

NOTE. CONTROL AS FOLLOWS.

MINIMUM DISTANCE BETWEEN DWELLINGS, FRONT TO FRONT, REAR TO REAR OR FRONT TO REAR 50' 0" & SIDE TO SIDE 20' 0"

AND NO SITE COVERAGE TO EXCEED 30% COVERAGE.

TABLE 1. GIVES DIMENSIONS OF HOUSES USED IN TABLE 2.

TABLE 2. SHOWS HOW MINIMUM SPACING CONTROLS STAND SIZES FOR DETACHED, & SOME SEMI-DETACHED DWELLINGS WHERE AS COVERAGE CONTROLS THE REMAINDER.

• DISTANCES & COVERAGE TABLES.

• PLATE NUMBER B R A / K / 23.

When row houses or multi-family dwellings are considered the following facilities should be provided:-

- (i) Waterborne sewerage.
- (ii) Adequate access for rubbish removal.
- (iii) Adequate cross ventilation and lighting within the dwellings.

The final decision on the size of the plots should be made only after the following relevant factors have been considered:-

- (a) Cost of land.
- (b) The services to be supplied to site; e.g. if pit latrines are considered, larger sites than those mentioned in the table above are necessary. Pail latrines will call for a minimum depth of plot of about 61 ft. (see Fig. 24).
- (c) Topography of site and the condition of soil.
- (d) In the case of row houses, a minimum site frontage of 21 ft.\* should be aimed at, and as the resultant plot will become too elongated if the area of the plot is maintained, the areas which are taken from the individual plot areas should be collected and provided as communal open space directly connected to the dwelling group. For example, for an area of 2600 sq.ft. the resultant size of the plot is 21'0" x 123'9", or for an area of 2400 sq.ft. the size of the plot is 21'0" x 114'1". The depth of plot in both cases is excessive and, therefore, the system of collecting areas and providing communal open spaces directly connected to the dwellings is necessary (see Figs. 25 and 26).

In any population, a certain proportion of the people is not going to need the same type of dwelling as that required by the average family and it is necessary to consider single quarters and minimum units for aged people. The proportion of aged urban non-Europeans is increasing gradually, but no probable percentages can yet be given. It is necessary, however, in each layout of housing to consider these aspects, and to make some provision for them.

Table XVII is given to show how much area of land is necessary to accommodate various numbers of persons in different plot sizes. This table is based on plot sizes only and allows for a family size of 5 persons, which is slightly in excess of what may be found to be the case: this occupancy figure, however, makes provision for a small percentage of the total population being housed in single quarters and old age dwellings.

TABLE XVII / ...

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\* In considering the functions of the plot viz. outdoor living, children's play, clothes drying area, refuse storage, cultivation and possibly a small store room, the frontage of 21 ft. was found to be the minimum suitable to allow for good planning, fresh air and sunlight.

TABLE XVII.

Net area in acres required for houses only.

Population of estate.	Average area of plots in square feet.											
	3500	3400	3300	3200	3100	3000	2900	2800	2700	2600	2500	2400
1000	16.07	15.61	15.15	14.7	14.23	13.774	13.315	12.856	12.4	11.938	11.478	11.02
2000	32.14	31.22	30.30	29.4	28.47	27.548	26.63	25.712	24.8	23.876	22.956	22.04
3000	48.21	46.83	45.45	44.1	42.7	41.322	39.945	38.568	37.2	35.814	34.434	33.06
4000	64.28	62.44	60.6	58.8	56.93	55.096	53.26	51.424	49.6	47.752	45.912	44.08
5000	80.35	78.05	75.75	73.5	71.16	68.87	66.575	64.28	62.0	59.69	57.39	55.1
6000	96.42	93.66	90.9	88.2	85.4	82.644	79.89	77.136	74.4	71.628	68.868	66.12
7000	112.49	109.27	106.05	102.8	99.63	96.418	93.205	89.992	86.8	83.566	80.346	77.14
8000	128.56	124.88	121.2	117.5	113.86	110.192	106.52	102.848	99.2	95.504	91.824	88.16
9000	144.63	140.49	136.35	132.2	128.1	123.966	119.835	115.704	111.6	107.442	103.302	99.18
10000	160.7	156.1	151.51	147.0	142.33	137.74	133.15	128.56	124.0	119.38	114.78	110.2
Zone of detached houses												
					75% D. 25% S.D.	50% D. 50% S.D.	25% D. 75% S.D.	100% S.D.	50% S.D. 50% R.	Zone of row houses.		

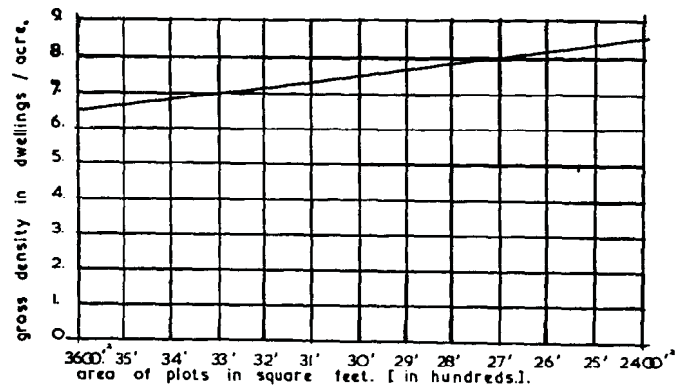
S.D. = Semi-detached houses.

D. = Detached houses.

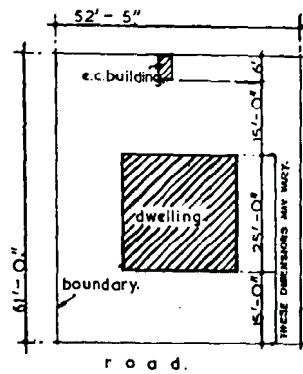
R. = Row houses.

NOTE: For calculating the table an average family size of 5 persons was taken thus making allowances for old persons, single quarters etc. in the overall areas.

# PLOT SIZE STUDY & RELATION TO GROSS DENSITY.



GRAPH RELATING GROSS DENSITY TO PLOT SIZES.



plan of site showing minimum depth.

a typical example of the minimum depth of a plot in cases where no waterborne sewerage is present results in 61'-0," made up of 15' building line, 25'depth of house, 15' from house to latrine & 6' for latrine building.

Fig. 24.



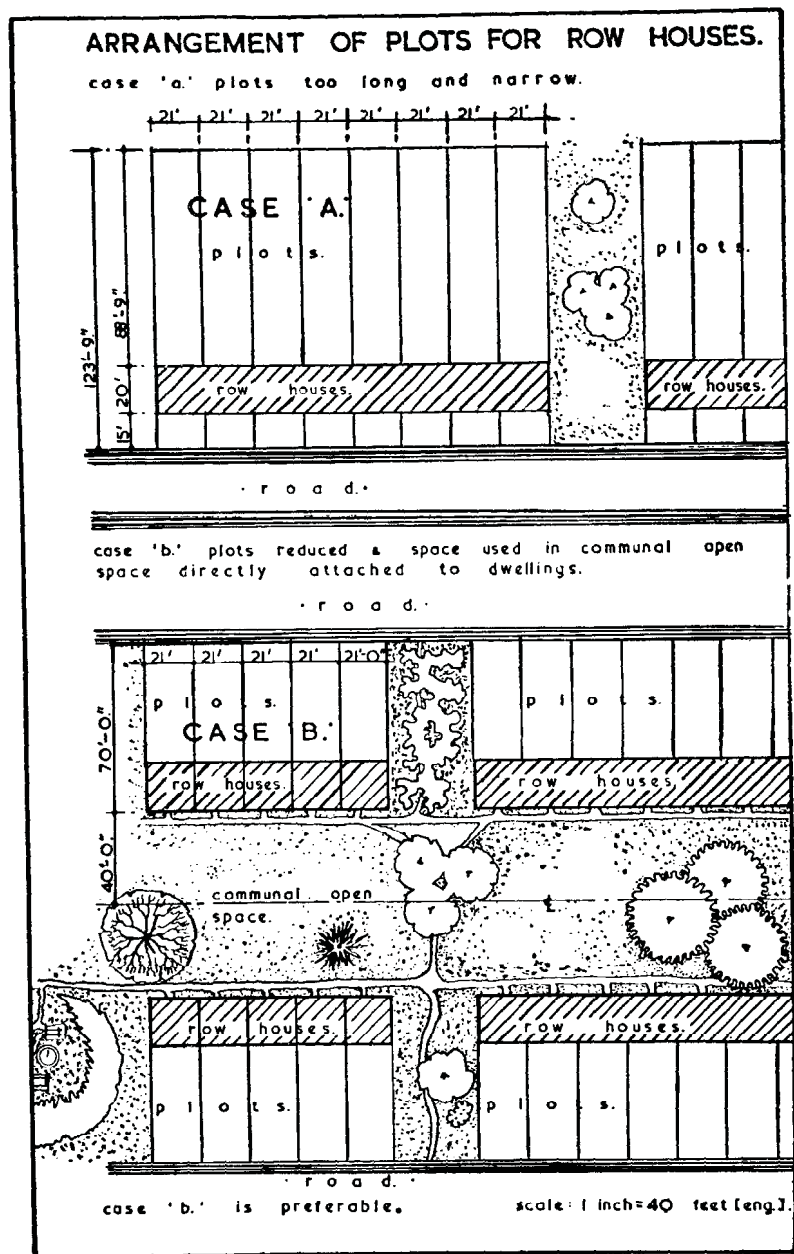
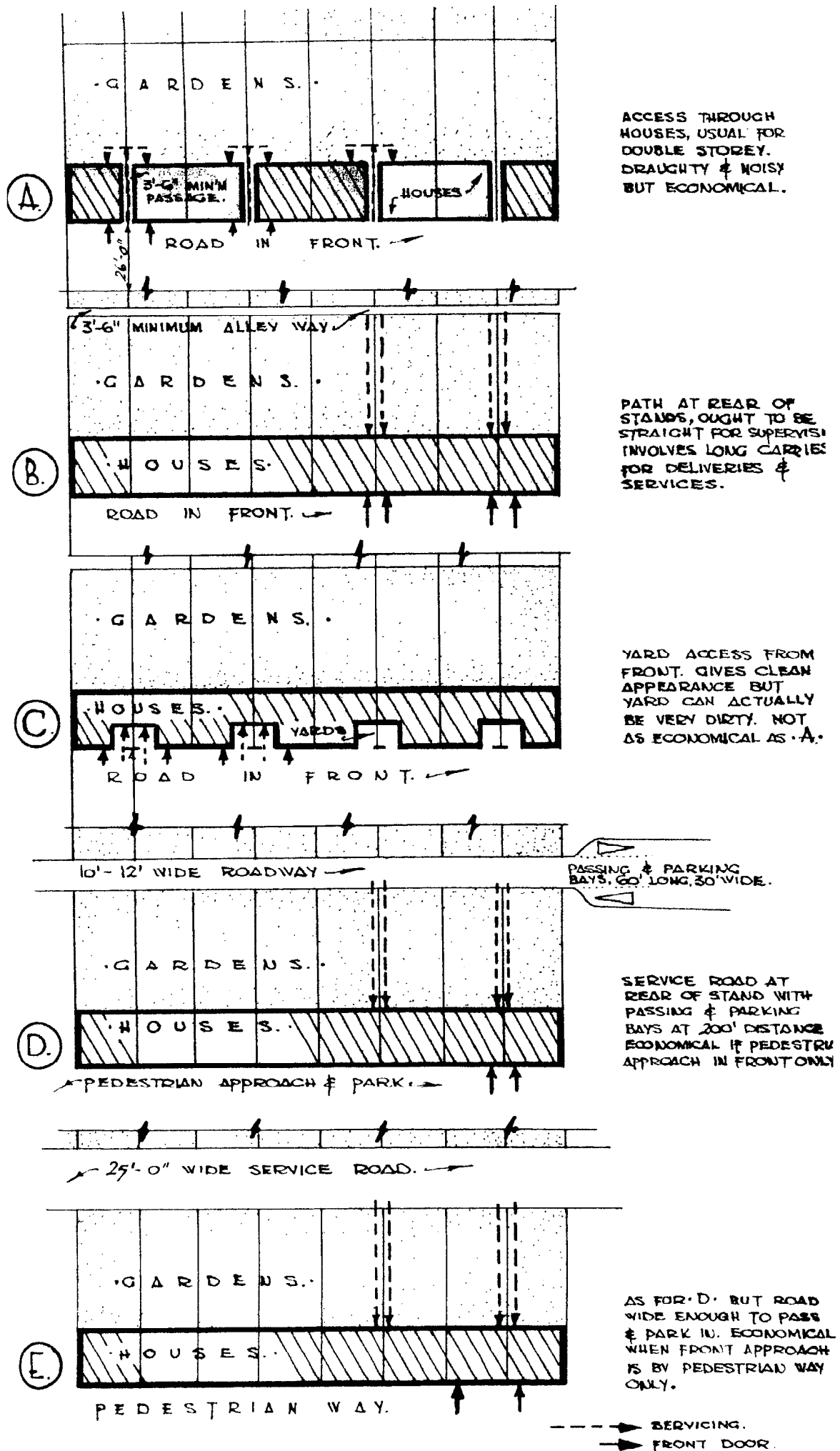


Fig. 25.





• SERVICE ACCESS TO ROW HOUSES. •

The table of plot sizes given below may be used as a guide in considering layouts.

TABLE XVIII.

Variations of plot sizes for different house types.

Types of house.	Ideal* plot sizes.	Min. plot sizes.	Net density range, <sup>1)</sup> in dwellings/acre.
Detached	50' x 70' 45' x 75'	45' x 70' 40' x 80'	12.4 to 13.6
Semi-detached	40' x 75'	40' x 70' 35' x 80'	14.5 to 15.6
Row	25' x 75' 21' x 80' with remain- ing area in communal space direct- ly attached to dwelling units.	25' x 70' 21' x 80' with remain- ing area in communal space direct- ly attached to dwelling units.	

MULTI-FAMILY, MULTI-STOREY DWELLING UNITS.

The problem of supplying sufficient space for man's outdoor activities has quite a different aspect when flats are considered. There are also other forms of multi-family dwellings, such as double storey row houses, which, in order to arrive at higher densities may be provided with little or no private plots but a communal space. In the future, outdoor space may have different solutions, but in dealing with to-day's problem, some indication of out-door space provision, closely related to the dwelling, must be known. The block of flats standing on its plot with the usual maximum coverage, which, when garages and parking spaces have been provided, results in no garden space save an architectural-ly treated wall box growing sweet papers and cigarette ends, must be considered to have certain limitations. Many arguments are put forward against flats in South Africa, whereas in America a flat is accepted as forming a suitable family dwelling unit. The reason for this contradiction is to be found in the provision of open space in relation to the buildings. Arguments against flats usually begin with the question - where can the children play? It is not the object of this work to deal with the argument of house or flat, but rather to examine the problem of outdoor multi-family unit space, which, if provided, would certainly make them more attractive to families with small children.

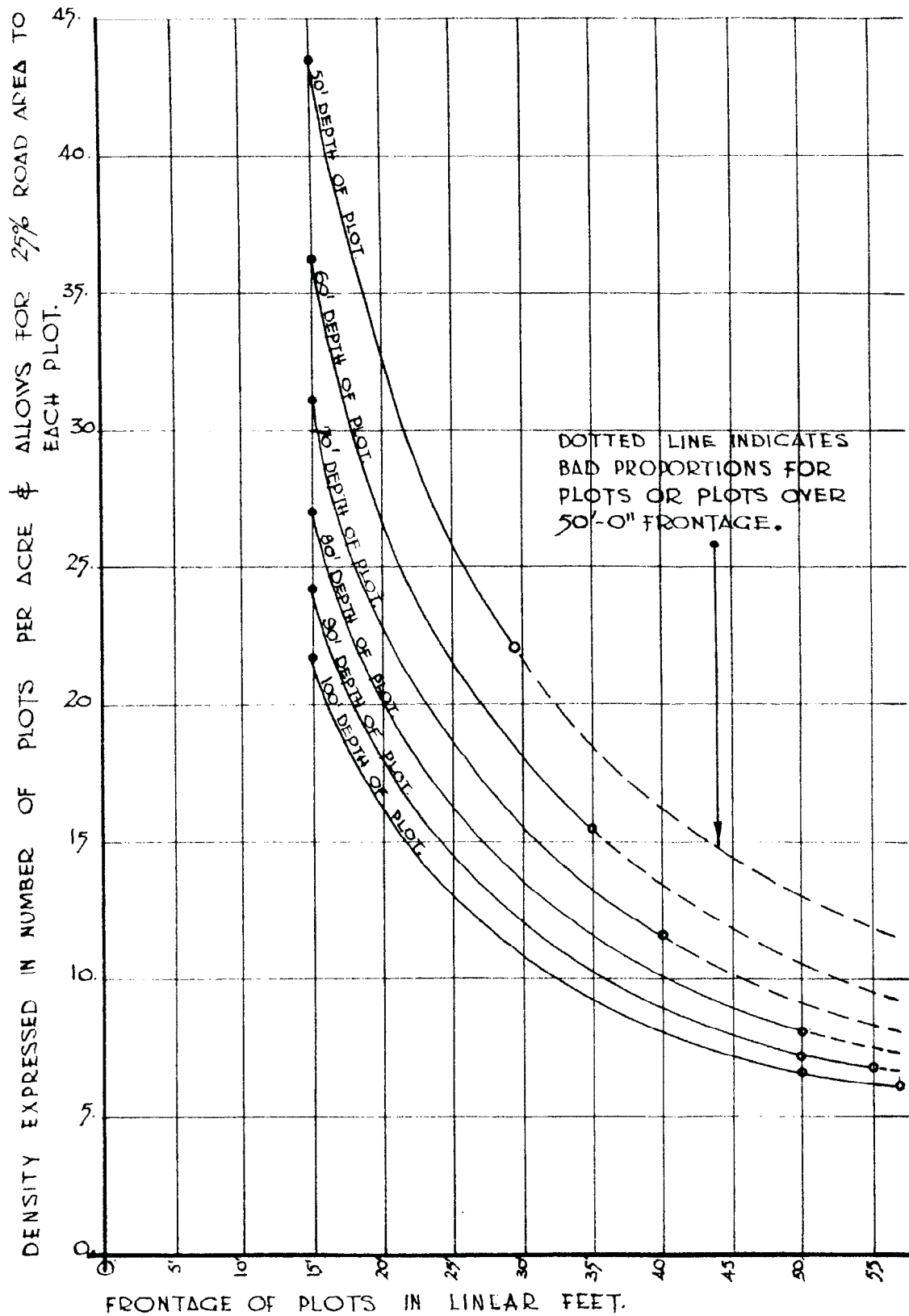
Outdoor / ...

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\* Plot sizes in villages for better-to-do Natives may receive individual consideration.

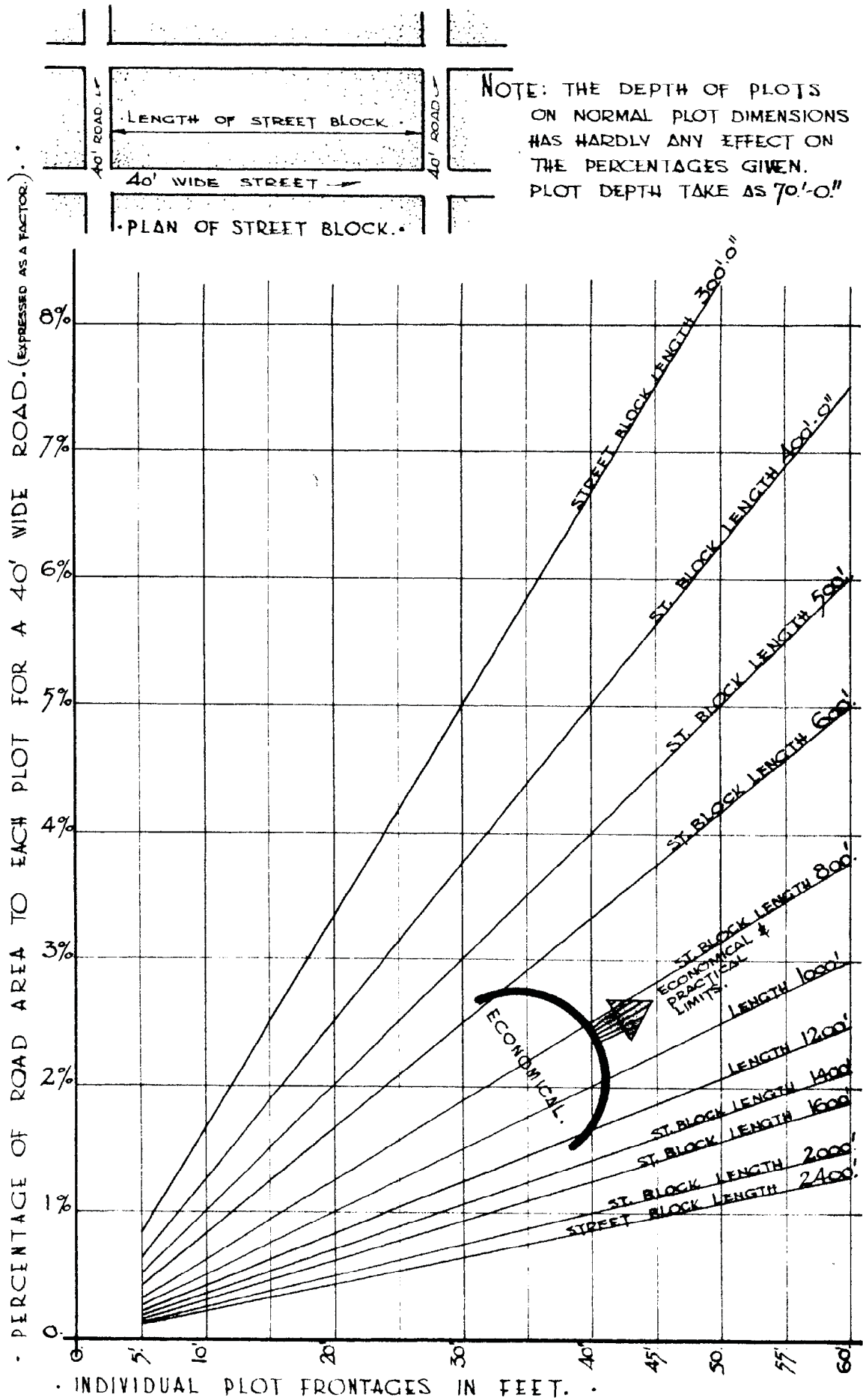
1) For plot sizes related to net density see Fig. 27 and the economies of street blocks see Fig. 28.

# ECONOMY OF PLOT AREAS.



- GRAPH SHOWING RELATION OF PLOT
- DIMENSIONS TO NET DENSITIES
- ALLOWING 25% AREA FOR ROADS. •

# ECONOMICAL LENGTH OF STREET BLOCK.



- RELATION OF ROAD AREA PER PLOT,
- WHICH HAVE VARYING FRONTAGES, TO
- THE LENGTH OF STREET BLOCK.

Outdoor space, when considered as communal space, is more economical, as can be seen from the space required for a privately-owned swimming pool, and a public swimming bath, serving the needs of one family in the first case, and the needs of a whole community in the second. In the case of private dwelling plots, general facilities beyond the garden, were not discussed, so in considering the multi-family units, the same approach will now be taken. The space provisions of a communal space will then be:-

- (i) Services - laundry, clothes drying, dustbins, etc.
- (ii) Children's play space.
- (iii) Adult leisure space.
- (iv) Area for cultivation - or allotments.
- (v) Sufficient fresh air and sunlight to dwellings.

Peter Shephard, writing in the March issue of the Journal of the Institute of Landscape Architects, states that the principle of common garden layout is now fairly well-known, but this type of layout will not provide the necessary space unless full advantage is taken of saving space on streets. If a common garden is to succeed, a width from house to house of 150 - 200 ft. is required, so that it may contain trees and shrubs.

Maintenance of the common garden is recognised as being a difficult problem, and the author makes a strong plea for a naturalistic form of landscaping - trees tough and large, shrubs and herbs native or naturalised, grass in most parts rough - for its own sake, and because the result should be durable and comparatively maintenance free.

With these words of warning, it is as well to consider in detail the space provisions of communal gardens.

#### (i) SERVICE IN COMMUNAL GARDENS.

Laundry facilities are best located at a central point, but in considering the housewife, some provision must be made within the dwelling unit for about 20'-0" of drying lines. A laundry and drying yard for 50 families would require about 1400 sq. ft. of drying yard and 1000 sq. ft. for laundry space. The drying area is based upon 15 ft. of clothes line per family, and allows for necessary passages etc. In a scheme where economy will permit electric washing machines with spinner driers, the drying area can be omitted. Garbage cans require an area of 150 sq. ft. per 50 families. Storerooms for garden tools will be dealt with under allotments.

When considering services, parking areas and garages play an important part. In planning for areas where the incomes of the people vary, the provision of parking spaces will vary according to the needs of the people concerned. In planning for high wage earners in South Africa, almost 100% provision must be made, whereas for low wage earners, no garage facilities are required. Parking is, however, necessary for delivery vehicles etc.

In planning then, an understanding is necessary of the income groups to be housed. A flat or dwelling having a rental of over £16 per month will require about 150 sq. ft. of garage and 200 sq. ft. of parking space, whereas in a housing scheme where rentals are £3 and less per month, the garages required are about 10 per 100 families, with parking provision of 25 parking bays per 100 families.

In Native housing the following service areas for 100 families or 500 persons is recommended.

Laundry and clothes drying space	4,800 sq. ft.
Garbage collection area	300 sq. ft.
Garages and parking areas*	<u>3,700 sq. ft.</u>
TOTAL SERVICES	<u>8,800 sq. ft.</u>

(ii) CHILDREN'S PLAY SPACE IN COMMUNAL GARDENS.

These areas are planned to meet the immediate needs of the children, and are therefore designed mainly for small, pre-school, children. They are not intended for organised games suitable for older children, as these should be removed a short distance from the dwelling units, owing to noise. The local play area must provide safety for the children, and must be attractive, otherwise they will stray from it.

The area must contain provisions such as shade or shelter, sand pit, paved area for wheeled toys, turfed area, swings, seats, rocks, tree stumps, or sculpture to fill the imagination of the small child. The Americans have also experimented with spray areas which consist of a paved area surrounding a fine jet spray; these areas are very popular in mid-summer, and give almost as much fun as a swimming bath without the dangers of drowning. The area required for these uses is difficult to assess, but, as a minimum requirement, an allocation of 50 sq. ft. per family is required, with no area being less than 2000 sq. ft.

For organised play, the general provisions of the greater layout should satisfy this requirement, but if traffic hazards exist between dwelling and play area, or if sufficient space is not provided in the layout, then it is necessary to provide an area of  $1\frac{1}{2}$  acres per 100 families, or if the area contains less than 100 families, at the rate of 300 sq. ft. per dwelling.

(iii) ADULT LEISURE IN COMMUNAL GARDENS.

When considering open space in the private garden, an allowance was made for recreation. In communal gardens this should be omitted but if multi-type dwellings are considered then a patio, balcony or verandah must be provided with each dwelling, to give some private open air space.

To / ...

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\* In Native housing 5 garages and 15 parking bays, are allowed to each 100 families, but it must be stressed that if the car owners exceed this number the figures must be increased.



To allow for sports immediately connected to the dwelling units may be necessary, but at the same time they introduce noise. Sport such as tennis, bowls etc., can be removed a short distance from dwellings, but passive recreation is required close to them. This recreation is mainly for older persons, for the housewife to relax in a place other than the dwelling, and for the short stroll before the evening meal. The area should contain trees, shrubs, seats, paved walks and possibly flowers. An allowance of 200 sq. ft. per dwelling is a considered minimum for this item.

(iv) AREA FOR CULTIVATION IN COMMUNAL GARDENS.

In England and in Europe allotment gardens are often contained within a housing estate. The area of an allotment is about 5,500 sq. ft. and these are usually removed away from the dwelling units, and at a rate of about 1 garden per 4 families. If gardens are required close to dwellings in order to raise vegetables for family consumption only, then 400 sq. ft. per family at the rate of 1 allocation per three families ought to be sufficient. In addition, a provision of a 15 sq. ft. tool shed must be made for each 12 allotments.

(v) CONTROL OF LIGHT AND FRESH AIR TO DWELLINGS.

The following data gives a good guide to the spacing between dwellings in arriving at control of sunlight and ventilation. The distance between buildings front to front, rear to rear, or front to rear, should be 50 foot for single storey units increasing 5 ft. for each additional storey. The side space between buildings should be 16 ft. for single storey units, and should be increased 5 ft. for each additional storey.

NOTE: In multi-family, multi-storey buildings for low income groups it is recommended as a minimum standard that a balcony be provided to each dwelling unit. This would assist greatly in providing privacy and, if families with small children are housed in this form of dwelling, will supply an essential emergency drying area. The area of 800 sq. ft. is, therefore, taken for the dwelling, and allows a balcony and vertical and horizontal circulation.

TABLE XIX.

Collection of Areas in Communal Garden Layout (Native Housing Layout.)

Areas for 100 families or 500 persons.

Cultivation area .....	13,250 sq. ft.
Services .....	8,800 sq. ft.
Children's play area .....	5,000 sq. ft.
Adult leisure area .....	20,000 sq. ft.
TOTAL .....	<u>47,050 sq. ft.</u>

The above makes no provision for school age children, since it assumes a layout having full amenities beyond the dwelling sites, as discussed later. The area allowed per dwelling unit and the space provisions of outdoors can now be applied to dwellings of various heights resulting in the reduction of space per family required by taller buildings.



In order, however, to prevent overcrowding of buildings on sites a minimum coverage of 30% if retained, as this affects 2 and 3 storey buildings.

TABLE XX.

Allocation of Areas in Multi-Storey Dwellings.

Height of building in storeys.	Area covered by building sq. feet.	Outdoor area per family sq. feet.	Total area per family sq. ft.
2 storey	400	470	1330 sq. ft.**
3 storey	266	470	890 sq. ft.
6 storey*	133	470	603 sq. ft.
12 storey	66	470	536 sq. ft.

TABLE XXI.

Net Area in Acres Required for Multi-Family Multi-Storey Dwellings only (Ref. Table XX).

Dwelling Type	Population of Estate.									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
2 Storey	6.10	12.20	18.30	24.40	30.50	36.60	42.70	48.80	54.90	61.00
3 Storey	4.08	8.16	12.24	16.32	20.40	24.48	28.56	32.64	36.72	40.80
6 Storey	2.77	5.54	8.32	11.08	13.85	16.62	19.39	22.16	24.93	27.70
12 Storey	2.46	4.92	7.38	9.84	12.30	14.76	17.22	19.68	22.14	24.60
All figures in Acres.										

The resulting net densities of the minimum spaces recommended for the various dwelling types is as follows:

Detached / ...

\* When a building's height is increased to more than three storeys, stair access is difficult, and a lift is required which would demand a structure of at least 6 storeys in height to be economical.

\*\* Figures adjusted to give a maximum of 30% building coverage of area of residential plot.

Detached houses - single storey	13.6 dwellings/acre.
Semi-detached houses - single storey	15.6 dwellings/acre.
Row houses - single storey	18.2 dwellings/acre.
Row houses - double storey	20.0 dwellings/acre.
Two storey multi-family units	32.8 dwellings/acre.
Three storey multi-family units	49.0 dwellings/acre.
Six storey multi-family units	72.2 dwellings/acre.
Twelve storey multi-family units	81.3 dwellings/acre.

## 2. SCHOOLING AND EDUCATIONAL PROVISIONS.

For a non-European area, the provision of schools presents some difficulties. The space may be provided, but the buildings may only be erected at a much later date. Basically, however, there remains the fact that space provided now, will prevent complications in the future, and will immediately provide the children with essential out-of-door play areas.

The types of schools required are creches, primary schools, and secondary or technical schools. A rough guide to the provision of schools is outlined, but this is by no means a standard, and will need reviewing in each particular case.

Crèches. These require half acre plots, each of which can serve about 300 dwellings. The resultant attendance would be about 40 pupils; if, however, the function of the building is to serve as a crèche entirely and no nursery education is contemplated, then the number of children attending can be increased to between 100 and 150.

Primary Schools. These require a 4 acre\* plot for every 400 dwellings. This school which will accommodate from 640-735 pupils, will provide for a greater population than normally housed in 400 dwellings, but this will cover possible overcrowding within dwelling units. To allow for transition from primary schooling to secondary schooling, a few of the plots for primary schools should be considered at 6 acres.

Secondary Schools. A secondary school requires about 12\* acres of land and is provided for at the rate of one secondary school for every three or four primary schools. (See Table XXII).

The provision of school sites for non-European housing schemes is one requiring a great deal of research. The analysis of a population in a Native Township in an urban area will immediately show a greater number of children of school-going age (6 to 17 years) to a given number of adults (18 years and over) than will be the case in the normal European urban population. From this observation is seen the necessity for further research into both the demographic and economic structure of urban Natives.

Table / ...

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\* Based on the British Ministry of Education's publications 'Building Bulletin 1, New Primary Schools' and 'Building Bulletin 2, New Secondary Schools', but allowing each pupil only one game per week.

TABLE XXIII.

Area required for outdoor recreation in acres.

Item	Population.									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Play lots.	See in creches.									
Children's play	See in schools.									
Recreation	$3\frac{1}{4}$	4	5	7	$7\frac{1}{2}$	9	$10\frac{1}{2}$	11	11	$12\frac{1}{2}$
Parks	1	2	3	4	5	6	7	8	9	10
Total in acres	$4\frac{1}{4}$	6	8	11	$12\frac{1}{2}$	15	$17\frac{1}{2}$	19	20	$22\frac{1}{2}$

4. INDOOR SOCIAL AND CULTURAL AMENITIES.

These include the community centre, churches, cinema and administrative buildings. The community centre will provide club rooms, offices, library, restaurants and a hall; space should also be provided for certain open air functions associated with the main hall. In cases where the number of persons does not warrant the erection of a community centre building, the site ought to be provided so that it may cater for certain open air activities.

Amongst non-Europeans there are usually numerous churches of different denominations, the congregations ranging from as little as 20 persons. A system of using school buildings, community hall, etc. may aid in reducing the large number of church sites required. Beyond any arrangement as suggested above, an allowance of a  $\frac{1}{2}$  acre site per 1,000 persons is necessary.

A cinema site is considered as a  $\frac{1}{2}$  acre plot per 10,000 population; for smaller groups of population a site in one of the parks could be set aside for an open air cinema.

Administration allowances have to be made and these will vary greatly, dependent on the size of the area and its location to any existing administration sites. The table below suggests provision for these.

TABLE XXIV.

Area of indoor social and cultural amenities in acres.

Item	Population.									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Community hall		$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Churches	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
Cinema										$\frac{1}{2}$
Administration		$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
Total	$\frac{1}{2}$	$1\frac{3}{8}$	2	$2\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	9

5. SHOPPING AND COMMERCIAL BUILDINGS.

This allocation should include shops, market place and a certain amount of space for small "on dwelling site" traders. Cartage contractors and hawkers need a yard from which to carry on business, and, unless some planning is considered, these businesses will spread haphazardly throughout the residential area. The problem can be solved by zoning certain areas for traders and light industries such as cartage contracting, builders' yards, etc. and providing increased plot areas for these "on dwelling site" traders within these zones. (See Table XXV)

TABLE XXV.

Table of shopping and commercial areas in acres.

Item.	Population.									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Shops.	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1	$1\frac{1}{2}$
Market.					$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$
Traders*	$\frac{1}{8}$ *	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1
Total	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{7}{8}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{1}{4}$

6. HEALTH PROVISIONS.

The provisions here include clinic, maternity home, nursing home, ablution blocks and cemetery.

Clinics should be provided at the rate of 1 acre site per 10,000 persons and maternity and nursing homes at a further 1 acre site for 10,000 persons. In areas containing less than 10,000 persons, a dental and health clinic only should be provided. Ablution blocks should be considered as an  $\frac{1}{8}$  acre plot per 100 dwellings or 500 persons. Each ablution block should contain 8 shower points and 8 washtubs per 100 dwellings. These ablution blocks are only necessary where water is not laid to each individual plot within the scheme.

In allowing for cemetery sites an area of 6 acres per 10,000 persons should be set aside, but this allocation is dependent upon the nature of the soil. (See Table XXVI)

TABLE XXVI /...

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\* 2 sites of 4200 sq. ft. per 1000 population, which will be for "on dwelling site" traders, are allowed, and this is an extra 2,000 sq. ft. per site for table compilation.

TABLE XXVI.

Area for health requirements in acres.

Item.	Population.									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Clinic			$\frac{1}{2}$	$\frac{1}{2}$	1	1	1	1	1	1
Nursing home								$\frac{1}{2}$	1	1
Ablutions	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$
Cemetery	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6
Total	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{3}{4}$	$3\frac{1}{2}$	$5\frac{1}{4}$	6	$6\frac{3}{4}$	8	$9\frac{1}{4}$	$10\frac{1}{2}$
Total less cemetery site	$\frac{1}{4}$	$\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{1}{4}$	$4\frac{1}{2}$

7. ROADS AND ACCESS WAYS.

In general terms, this includes roads, parking areas, bus terminus etc., and many factors have to be considered when allocating areas for these items. The gradient of the site, the shape of site, whether any proclaimed roads already exist on the site, the pattern of development envisaged by the planner, and, lastly, how much traffic is likely to be encountered in the area; these factors all affect the area that will be devoted to roads.

In planning layouts, the motor car is, however, not so important, because of the small proportion of vehicle owners, and it is from this point of view that a figure of 25%\* of the total area, has been set aside for access. This figure is only a guide, and if it can be reduced the complete scheme will benefit thereby.

As a guide, the following road widths are suggested, but planners have freedom to consider alternative sizes which will still allow for the proper functioning of the area.

(a) / ...

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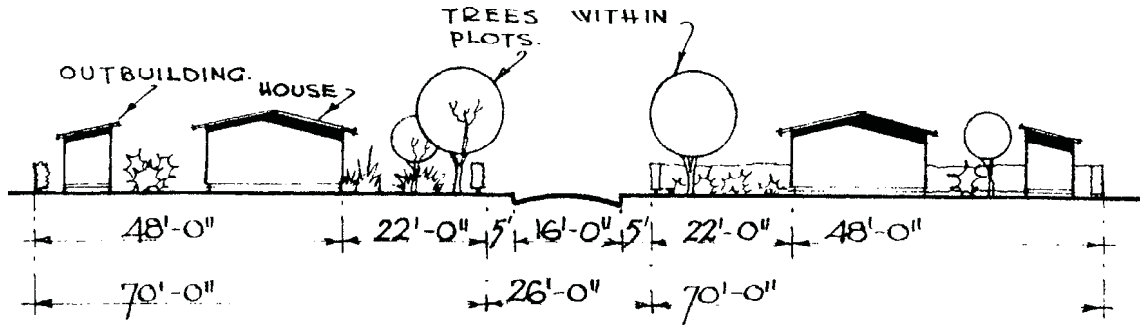
\* This percentage of area for roads has been determined by analysing 5 selected Native housing schemes submitted to the National Housing and Planning Commission. They covered a variety of topographical conditions and planning types.

In "Planning the Neighbourhood" the American Public Health Association recommends 22% of total area for streets serving detached houses and 21% for semi-detached houses.

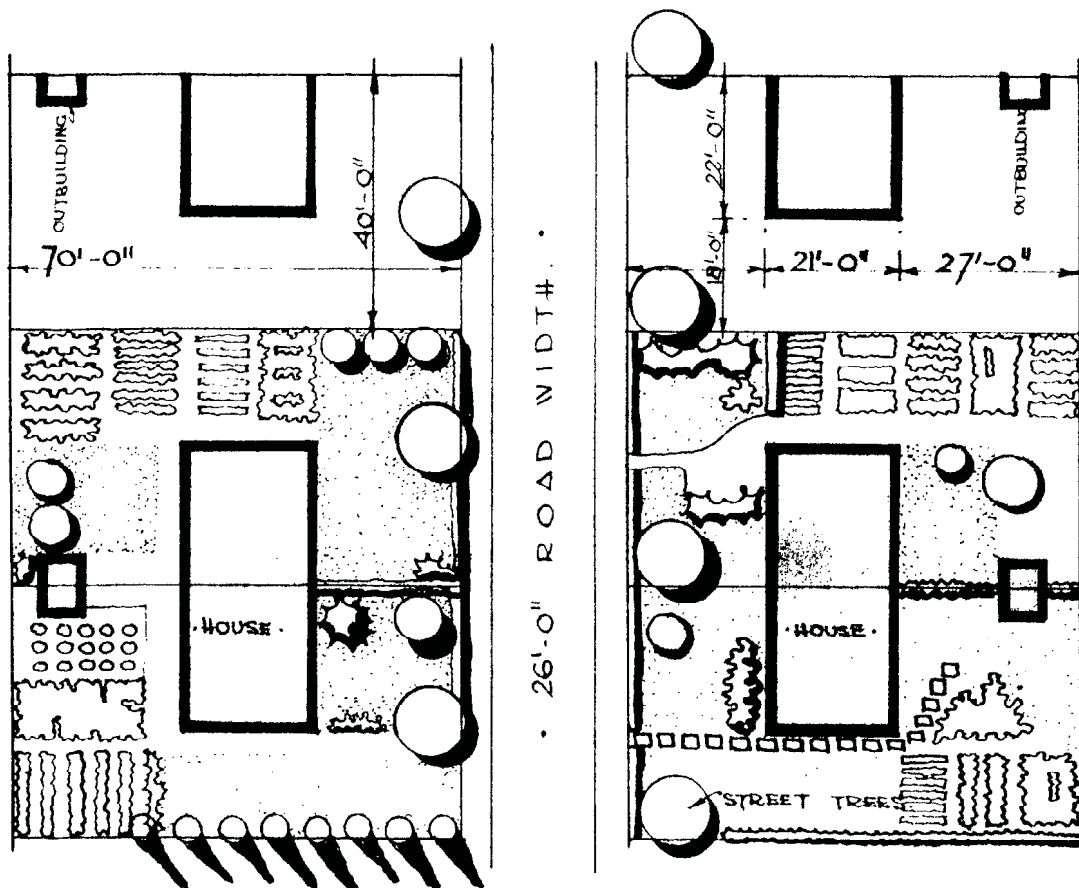
In "Township Layout" T.B. Floyd analysing various forms of layouts (six in number), obtained an average road area of 27.57% but this is based upon secondary roads 60'0" wide and reticulation roads 50'0" wide.

# REDUCED ROAD WIDTHS.

26'-0" RESIDENTIAL STREET.  
TREES PLANTED IN PLOTS.



. SECTION .

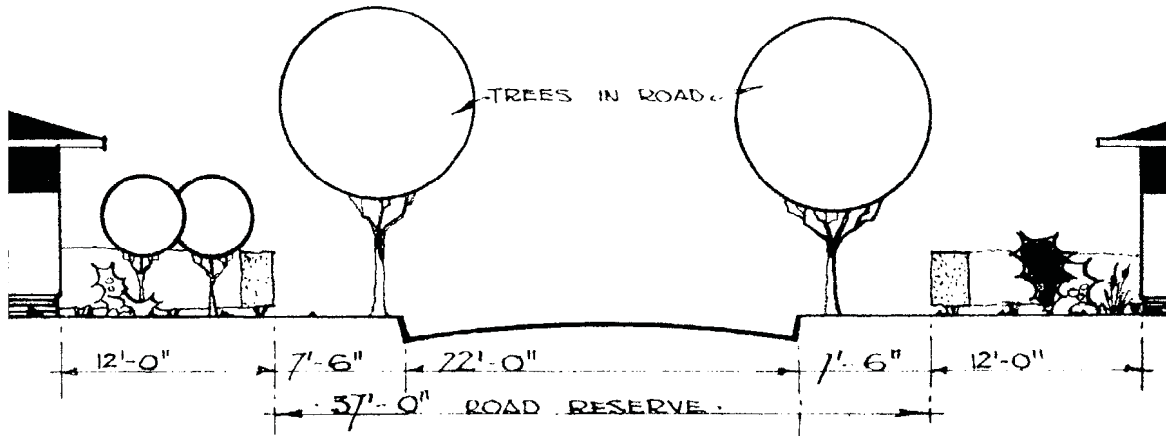


. PLAN . SCALE: 1 INCH TO 26 2/3 FEET .

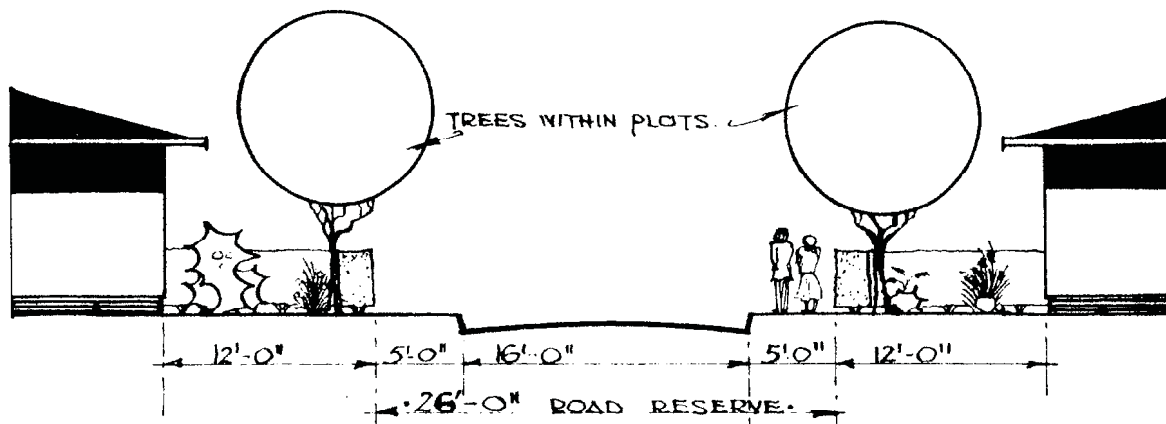
. THESE ROADS HAVE PROVED  
. SUCCESSFUL IN PRACTICE .

# REDUCED ROAD WIDTHS.

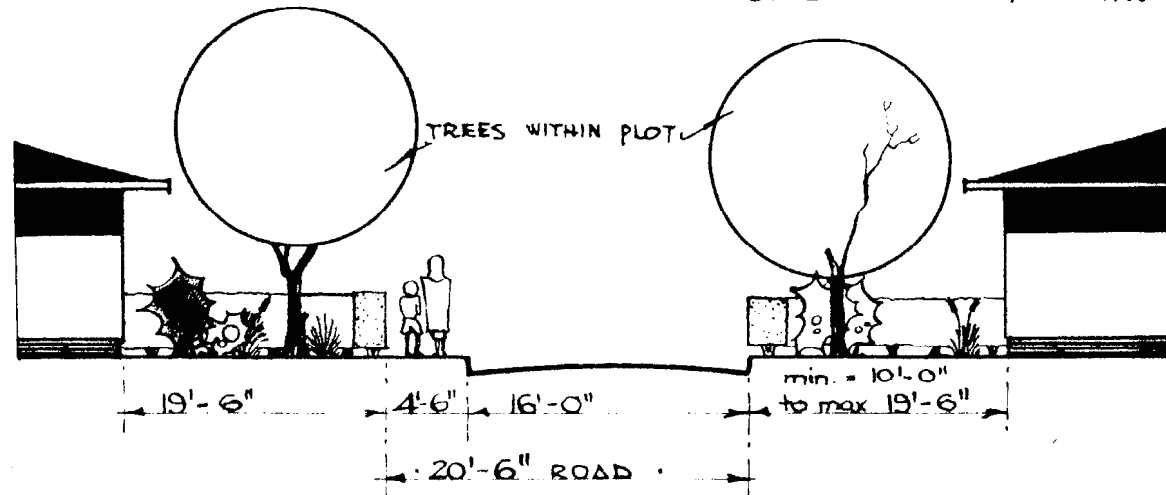
## MINOR RESIDENTIAL ROAD.



## HOUSING ROAD.



## SHORT ROAD OR CUL-DE-SAC 600 FT. MAX.



## SERVICE ROADS.

MAX. 300'-0" LENGTH.

AT 300'-0" PASSING BAY REQUIRED.

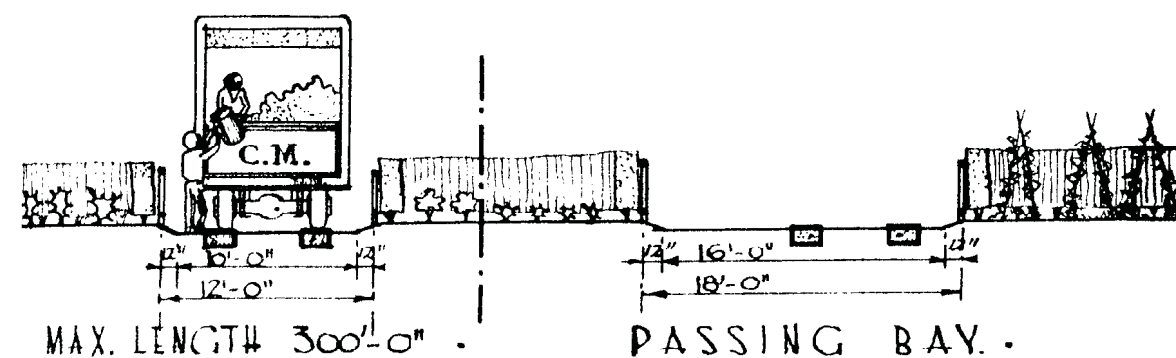




TABLE XXVII.

Collection of all areas to be provided for in neighbourhoods except housing.

ITEM.	Population.									
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Schools	$1\frac{1}{2}$	5	$7\frac{1}{2}$	$9\frac{1}{2}$	$11\frac{1}{2}$	12	16	20	$22\frac{1}{2}$	30
Outdoor recreation	$4\frac{1}{2}$	6	8	11	$12\frac{1}{2}$	15	$17\frac{1}{2}$	19	20	$22\frac{1}{2}$
Indoor social and cultural amenities	$\frac{1}{2}$	$1\frac{1}{8}$	2	$2\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	9
Shops	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{7}{8}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{1}{4}$
Health	$\frac{1}{4}$	$\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{1}{4}$	$4\frac{1}{2}$
Total	$6\frac{3}{4}$	$13\frac{3}{8}$	$19\frac{1}{2}$	$25\frac{1}{2}$	$31\frac{1}{2}$	$35\frac{7}{8}$	$43\frac{3}{4}$	$51\frac{1}{2}$	$56\frac{3}{4}$	$69\frac{1}{2}$
Cemetery* sites	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6

\* Cemetery sites are excluded in total as usually an area is provided separately outside the estate land considered.

N.B. - No provision has been made for industrial sites, disposal sites and buffer strips.

TABLE XXVIII.

ensity tables for single storey development.

Population.						
4000 persons or 800 dwellings	5000 persons or 1000 dwellings	6000 persons or 1200 dwellings	7000 persons or 1400 dwellings	8000 persons or 1600 dwellings	9000 persons or 1800 dwellings	10000 persons or 2000 dwellings
25.50 64.28 29.926	31.50 80.35 37.283	35.875 96.42 44.098	43.75 112.49 52.080	51.25 128.56 59.936	56.75 144.63 67.62	69.25 160.7 76.55
119.706	149.133	176.393	208.32	239.746	269.0	306.5
6.68	6.70	6.80	6.72	6.67	6.70	6.52
25.50 58.80 28.10	31.50 73.50 35.0	35.875 88.20 41.358	43.75 102.80 48.85	51.25 117.50 56.25	56.75 132.20 63.05	69.25 147.00 72.750
112.400	140.000	165.433	195.400	225.000	252.000	289.000
7.11	7.14	7.25	7.16	7.11	7.13	6.93
25.50 55.096 26.865	31.50 68.870 33.456	35.875 82.644 39.456	43.75 94.418 46.723	51.25 110.192 53.814	56.75 123.966 60.284	69.25 137.74 69.01
107.461	133.826	158.025	186.891	215.256	241.000	276.000
7.44	7.47	7.59	7.49	7.43	7.47	7.24
25.50 51.424 25.641	31.50 64.28 31.926	35.875 77.136 37.67	43.75 89.992 44.58	51.25 102.848 51.366	56.75 115.704 57.546	69.25 128.56 65.79
102.565	127.706	150.681	178.322	205.464	230.000	263.60
7.79	7.83	7.96	7.85	7.79	7.83	7.58
25.50 47.752 24.417	31.50 59.69 30.396	35.875 71.628 35.834	43.75 83.566 42.428	51.25 95.504 48.918	56.75 107.442 54.908	69.25 119.38 62.67
97.669	121.586	143.337	169.754	195.672	219.100	251.30
8.19	8.22	8.37	8.25	8.18	8.24	7.97
25.50 44.08 23.193	31.50 55.10 28.866	35.875 66.12 33.998	43.75 77.14 40.296	51.25 88.16 46.47	56.75 99.18 51.07	69.25 110.20 58.55
92.773	115.466	135.993	161.186	185.88	207.00	238.000
8.62	8.66	8.82	8.68	8.61	8.70	8.40

Resultant areas a

	Item.			
		1000 persons or 200 dwellings	2000 persons or 400 dwellings	3000 persons or 600 dwellings
Detached houses on 3500 sq. ft. plots.	Amenities	6.75	13.375	19.50
	Dwellings	16.07	32.14	48.21
	Roads	7.606	15.171	22.57
	Total in acres	30.426	60.686	90.28
	Gross density	6.57	6.59	6.64
Detached houses on 3200 sq. ft. plots.	Amenities	6.75	13.375	19.50
	Dwellings	14.70	29.40	44.10
	Roads	7.150	14.258	21.200
	Total in acres	28.6	57.033	84.800
	Gross density	7.00	7.00	7.07
Semi- detached houses on 3000 sq. ft. plots	Amenities	6.75	13.375	19.50
	Dwellings	13.774	27.548	41.322
	Roads	6.841	13.641	20.274
	Total in acres	27.365	54.564	81.096
	Gross density	7.31	7.33	7.40
Semi- detached houses on 2800 sq. ft. plots.	Amenities	6.75	13.375	19.50
	Dwellings	12.856	25.712	38.568
	Roads	6.535	13.029	19.356
	Total in acres	26.141	52.116	77.424
	Gross density	7.65	7.68	7.75
Row houses on 2600 sq. ft. plots.	Amenities	6.75	13.375	19.50
	Dwellings	11.938	23.876	35.814
	Roads	6.229	12.417	18.438
	Total in acres	24.917	49.668	73.752
	Gross density	8.03	8.05	8.135
Row houses on 2400 sq. ft. plots.	Amenities	6.75	13.375	19.50
	Dwellings	11.02	22.04	33.06
	Roads	5.923	11.805	17.520
	Total in acres	23.693	47.220	70.080
	Gross density	8.44	8.47	8.56

TABLE XXIX  
Resultant areas and densities for multi-family, multi-storey development.

Dwelling Type	Item.	1000 per- sons or 200 dwellings	2000 per- sons or 400 dwellings	3000 per- sons or 600 dwellings	4000 per- sons or 800 dwellings	5000 per- sons or 1000 dwellings	6000 per- sons or 1200 dwellings	7000 per- sons or 1400 dwellings	8000 per- sons or 1600 dwellings	9000 per- sons or 1800 dwellings	10,000 per- sons or 2000 dwellings.
Two storey develop- ment.	Amenities.	6.75	13.375	19.50	25.50	31.50	35.875	43.75	51.25	56.75	69.25
	Dwellings.	6.10	12.200	18.30	24.40	30.50	36.500	42.70	48.80	54.90	61.00
	Roads.	3.21	6.395	9.45	12.22	15.50	18.125	21.60	25.00	27.90	32.56
	Total in acres	16.06	31.970	47.25	62.12	77.50	90.600	108.05	125.05	139.55	162.81
	Gross density	12.45	12.51	12.7	12.87	12.9	13.25	12.96	12.79	12.9	12.28
Three storey develop- ment.	Amenities.	6.75	13.375	19.50	25.50	31.50	35.875	43.75	51.25	56.75	69.25
	Dwellings.	4.08	8.160	12.24	16.32	20.40	24.480	28.56	32.64	36.72	40.80
	Roads.	2.72	5.385	7.93	10.45	12.97	15.095	18.09	20.96	23.38	27.50
	Total in acres	13.55	26.920	39.67	52.27	64.87	75.450	90.40	104.85	116.85	137.55
	Gross density	14.76	14.86	15.11	15.3	15.42	15.9	15.49	15.26	15.40	14.54
Six storey develop- ment.	Amenities	6.75	13.375	19.50	25.50	31.50	35.875	43.75	51.25	56.75	69.25
	Dwellings	2.77	5.540	8.32	11.08	13.85	16.620	19.39	22.16	24.93	27.70
	Roads	2.09	4.185	6.08	8.07	9.95	11.555	14.06	16.29	17.95	21.20
	Total in acres	11.61	23.100	33.90	44.65	55.30	64.050	77.20	89.70	99.63	118.15
	Gross density	17.2	17.31	17.7	17.92	18.01	18.74	18.14	17.84	18.07	16.93
Twelve storey develop- ment.	Amenities	6.75	13.375	19.50	25.50	31.50	35.875	43.75	51.25	56.75	69.25
	Dwellings	2.46	4.920	7.38	9.84	12.30	14.760	17.22	19.68	22.14	24.60
	Roads	2.03	4.055	5.77	7.67	9.50	11.175	13.23	15.27	17.12	20.20
	Total in acres	11.24	22.350	32.65	43.01	53.30	61.810	74.20	86.20	96.01	114.05
	Gross density	17.8	17.90	18.38	18.6	18.76	19.41	18.87	18.56	18.75	17.54

The tables show that although high net densities can be obtained (from 13.6 dwellings/acre for detached single storey dwellings to 81.3 dwellings/acre for twelve storey flats) the resultant gross densities are not radically changed by a change in dwelling type. Gross densities range from 7.0 dwellings/acre for single storey detached units to 18.6 dwellings/acre for twelve storey flats. This range has a great bearing upon the decision of using high density layouts for Native housing, as will be seen from the graphs of development costs vs. higher densities. Further, the gross density figures are high if considered in terms of full neighbourhood development. The figures correspond to 35 persons/acre for single storey detached house development to ± 93 persons/acre in twelve storey flats, taken as gross figures for the whole neighbourhood area.

#### EFFECT OF REDUCED ROAD WIDTHS.

Reduced road widths have been discussed and it now remains to show the influence of reduced road widths upon the gross density figures. Considering only single storey development, as road reductions have already been made in multi-storey dwellings, the following is obtained:

TABLE XXX.

Effect of reducing road widths in relation to gross density. Figures for a neighbourhood of 10,000 persons only.

Type of Dwellings.	Items.	Roads @ 25%	Reduced Roads @ 20%	Increase in Gross Density.
Single storey detached houses,  3200 sq.ft. plots.	Amenities	69.25	69.25	
	Dwellings	147.00	147.00	
	Roads	72.75	54.05	
	Total in acres.	289.000	270.30	
	Gross Density.	6.93	7.4	+ 0.47 dwellings/acre.
Single storey semi-detached houses, 28,000 sq.ft. plots.	Amenities	69.25	69.25	
	Dwellings	128.56	128.56	
	Roads.	65.79	49.45	
	Total in acres.	263.60	247.26	
	Gross Density.	7.58	8.1	+ 0.52 dwellings/acre.
Row Houses on 2400 sq.ft. plots.	Amenities	69.25	69.25	
	Dwellings	110.20	110.20	
	Roads.	58.55	44.86	
	Total in acres.	238.00	224.31	
	Gross Density.	8.40	8.95	+ 0.55 dwellings/acre.

The increases in gross density are very slight but the constructional costs of roads are greatly reduced. In actual fact the 0.5 dwellings/acre increase in gross density is very considerable and brings layouts of row houses into the 9 dwellings/gross acre class. The main conclusion to be drawn from this investigation is the fact that a reduction in space of any one amenity will not radically affect the gross density figure. Changing the dwelling type, i.e. from single storey detached houses to a row house layout; or from a single storey row house development to one of six storey flats, is the only way to increase densities.

The following Figures 31 to 34 will assist in laying out single storey townships.

TABLE XXXI.

Table of average percentages in land uses.

Item.	% Residential	% Amenities	% Roads	% Total
Detached house on 3500 sq.ft. plot.	53.6	21.4	25	100
Detached house on 3200 sq.ft. plot.	52.4	22.6	25	100
Semi-detached house on 3000 sq. ft. plot.	51.1	23.9	25	100
Semi-detached house on 2800 sq. ft. plot.	50	25	25	100
Row houses on 2600 sq.ft. plots.	48.8	26.2	25	100
Row houses on 2400 sq.ft. plots.	47.4	27.6	25	100

TABLE XXXII / ...

# SPACE REQUIREMENTS & PERCENTAGES ALLOCATED TO LAND USES.

area of scheme in acres for a population of 5000 persons.				
types of houses	amenities.	dwelling.	roads.	total.
100% detached houses ○ ○ ○ ○	31.5	80.35	37.28	149.13
75% detached 25% semi. ○ ○ ○ ●	31.5	77.48	36.32	145.30
50% detached 50% semi. ○ ○ ● ●	31.5	74.61	35.37	141.48
25% detached 75% semi. ○ ● ● ●	31.5	71.74	34.41	137.65
100% semi-detached. ● ● ● ●	31.5	68.87	33.46	133.83
75% semi. 25% row. ● ● ● ⊗	31.5	65.43	32.31	129.24
50% semi. 50% row. ● ● ⊗ ⊗	31.5	61.99	31.16	124.65
25% semi. 75% row. ● ⊗ ⊗ ⊗	31.5	58.54	30.01	120.05
100% row houses. ⊗ ⊗ ⊗ ⊗	31.5	55.10	28.86	115.46

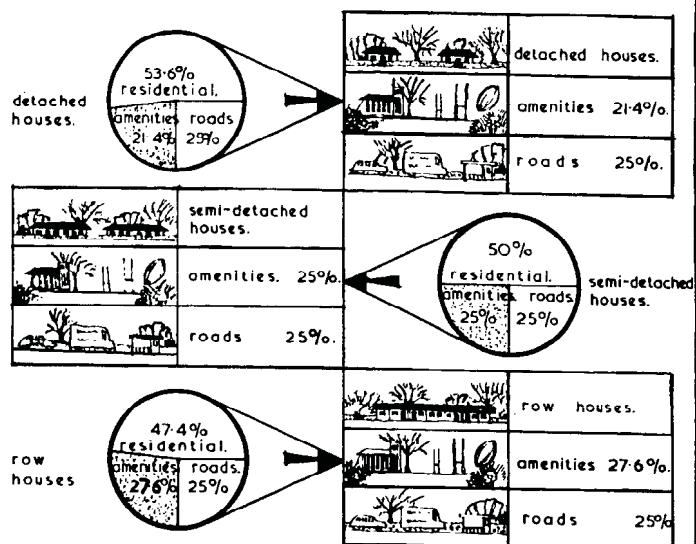


Fig. 31.



# DENSITY & AREA GRAPH FOR ROW HOUSES.

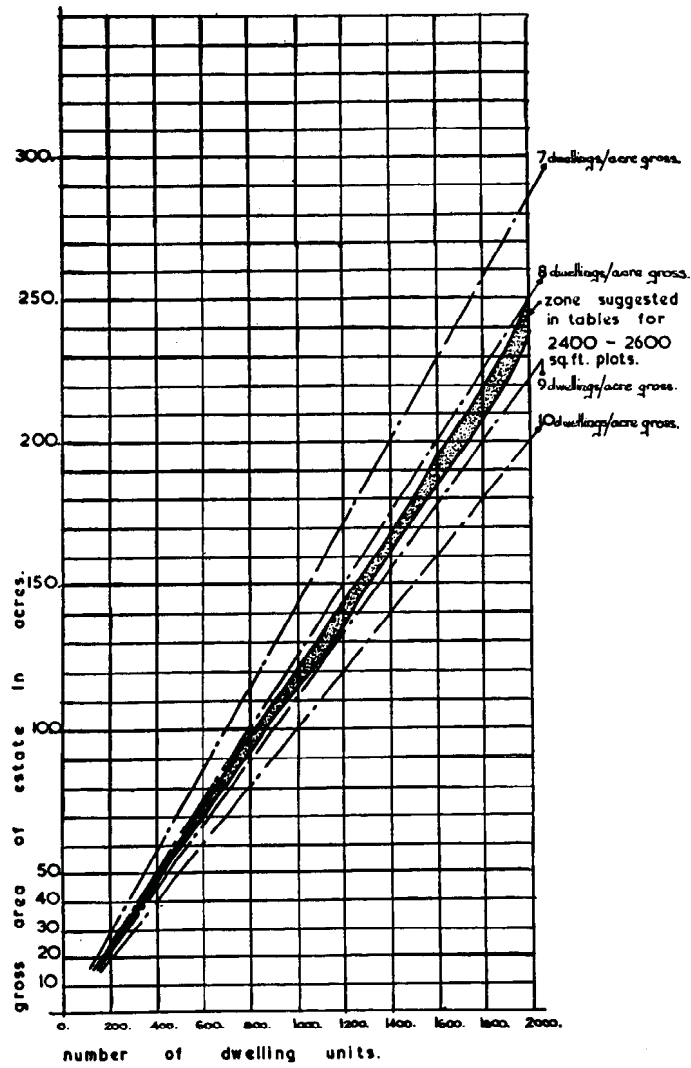


Fig. 32.